A TIERED APPROACH FOR CITIZEN-BASED MONITORING OF WADEABLE STREAMS AND RIVERS

Connecticut Department of Environmental Protection
Bureau of Water Management
Planning and Standards Division
Ambient Monitoring Program
Gina McCarthy, Commissioner

A TIERED APPROACH FOR CITIZEN BASED MONITORING OF WADEABLE STREAMS AND RIVERS

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Table of Contents

PURPOSE:

The purpose of this document is to provide guidance to those volunteer monitoring organizations that intend to submit usable water quality information for inland surface water resources to the Department of Environmental Protection (DEP) for use by the ambient monitoring program. The tiered approach outlined in this document is intended to encourage participation by volunteers having a wide range of skills and interest levels. It has been specifically developed by the DEP to insure optimal use of volunteer data.

INTRODUCTION:

Volunteer monitoring continues to attract interested citizens in Connecticut as well as nationwide. Since 1994, 255 groups nationwide (8 in CT) have been added to the National Directory of Volunteer Environmental Monitoring Programs. To date volunteer monitors have collected surface water quality data from over 100 sites across the state (Figure 1).

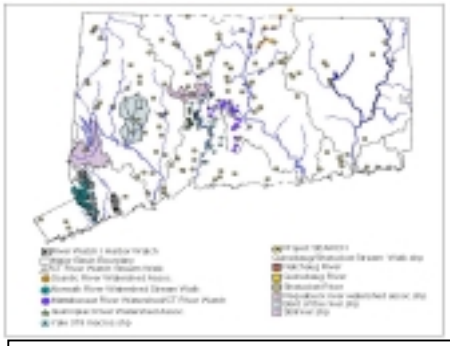


Figure 1. Location of volunteer monitoring surface water quality data collection.

The major benefits of a volunteer monitoring program can be to assist state and local resource managers, increase resource stewardship and environmental awareness, educate the general public, and most importantly assemble information specific to the objectives of the monitoring group.

While each volunteer monitoring organization is unique, the majority can be described as small groups of dedicated participants funded through a very limited budget (if at all). Their monitoring activities typically focus on water quality, intending to educate a variety of audiences and themselves about the physical, chemical, and biological condition of a waterbody. Data can be submitted to state and local officials in order to provide information about baseline conditions, screen for water quality issues, assess potential non-point source (NPS) pollution, and provide information for watershed planning.

There are many different water quality related resources available to volunteer monitoring organizations including manuals, web sites, equipment, and analysis techniques (see list of resources). Most are excellent and can be useful to meet specific goals and objectives. Unfortunately, water quality data generated through some of these methods may not be applicable for use by the DEP.

This guidance has been developed to assist and encourage volunteer monitors to submit meaningful monitoring data to the DEP. The various types of useful monitoring information are prioritized so that a volunteer monitoring organization, with the intent of submitting data to the CT DEP, can prioritize their resources and monitoring efforts.

WATER QUALITY MONTIORING BY THE CT DEP BUREAU OF WATER MANAGEMENT:

Connecticut's approximately 5,800 miles of perennial streams and rivers are monitored by staff assigned to the Ambient Water Quality Monitoring and Assessment Program within DEP's Bureau of Water Management. The monitoring program supports activities of the DEP by providing data (chemical, physical, and biological) and related expertise to assess surface water quality conditions and trends. Since it is not possible for the DEP to assess all of the waterbodies in the state, monitoring activities are prioritized and focus on the most significant resources, selected reference sites, and in response to nuisance complaints or concerns regarding pollution impacts. Historically, monitoring activities have focused on roughly 10% of the total stream miles (primarily on major rivers or streams having treated point source discharges).

Beginning in 1996, the DEP initiated a rotating basin approach for monitoring and assessment with the overall goal of a more comprehensive statewide assessment, by ultimately increasing the number of river miles monitored. To accomplish this plan the State was divided into five hydrologic assessment units comprised of one or two CTDEP major basins, or USGS cataloging units. The assessment units and assessment schedule are shown in Figure 2 and listed in Table 1.

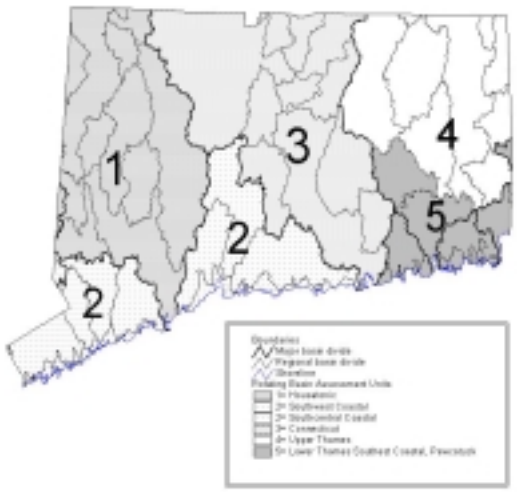


Figure 2. The rotating basin assessment units for DEP ambient monitoring.

During the assessment period (October 1 to September 30 of the following year), monitoring and assessment occurs at approximately 50 stations. Sampling at each station includes an annual macroinvertebrate community structure (fall) and quarterly physical/chemical grab samples (1 per season). In addition, intensive surveys or special monitoring projects may occur outside of the assessment unit. At the completion of the assessment period monitoring efforts switch to the next scheduled assessment unit. As a result of this plan the total number of stream miles assessed should increase to approximately 20 percent.

Table 1. Rotating Basin Assessment Units

Monitoring Year	CT DEP Major Basin, Code Number	USGS Cataloging Unit
1996-1997	Housatonic, 6000	01100005
1997-1998	Southwest Coastal, 7000 Southcentral Coastal, 5000	01100006 01100004
1998-1999	Connecticut, 4000	01080205 01080207
1999-2000	Upper Thames, 3000 (3100-3800)	01100002 01100001
2000-2001	Lower Thames, 3000 (3900) Southeast Coastal , 2000 Pawcatuck , 1000	01100003 01100003 01090005

Currently, the ambient monitoring program utilizes the aquatic invertebrate community as the primary indicator of biological integrity. Methods follow the USEPA Rapid Bioassessment Protocol III (RBP III) for Streams and Rivers (Plafkin et. al 1989). RBP III involves collecting, sub-sampling, and identifying macroinvertebrates, calculating a series of community structure metrics, and finally, comparing the metrics to those from a reference site. A reference site is a specific locality on a waterbody which is minimally impaired and is representative of the expected ecological integrity of other localities on the same waterbody or nearby waterbodies. The final result of RBP III is an assessment of the impairment level of the benthic community.

The primary use of RBP III assessments is to determine whether a section of stream supports or does not support the designated use goal for aquatic life (Figure 3). These assessments are also used for priority setting, trend monitoring, establishing baseline conditions, and evaluating wastewater discharges and NPS pollution.

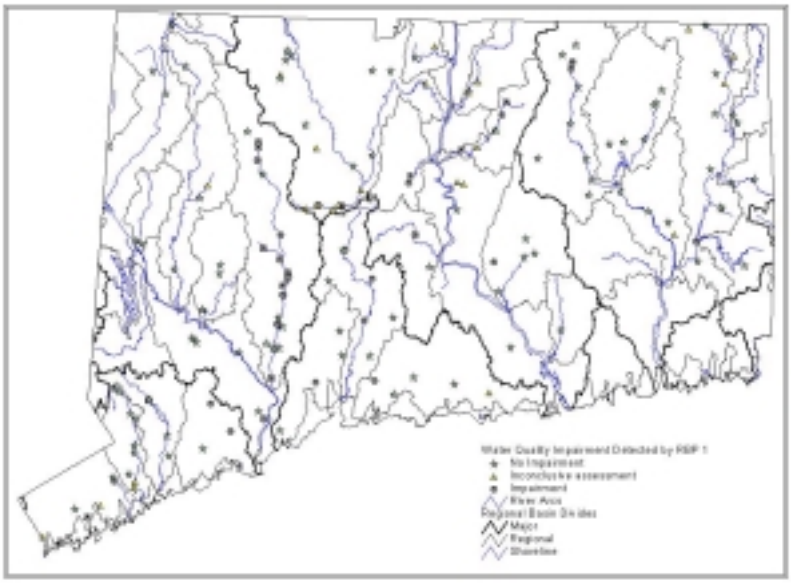


Figure 3. The level of benthic community impairment as determined by Rapid Bioassessment Protocol.

DEP's NEED FOR VOLUNTEERS:

Due to the DEP's limited resources and the large number of unmonitored waterbodies in Connecticut, the potential for volunteer monitoring organizations to augment DEP's monitoring efforts by submitting usable water quality information is quite large. Historically, data submitted by volunteers covered a variety of parameters, generated though a variety of methods for a variety of reasons. Unfortunately, due to the type and nature of this data and the limited resources available at the CT DEP, detailed evaluation of this information has not regularly occurred.

In June 1998, a staff position was added to DEP's monitoring program to assist in evaluating and assessing water quality data and to provide greater technical assistance to volunteer monitoring organizations to improve data quality. This has fostered the development of a monitoring database linked to a geographic information system (GIS) and increased evaluation of volunteer data. In an attempt to insure maximum and efficient use of volunteer data, the DEP recommends that groups intending to submit data to the DEP work closely with DEP's volunteer monitoring coordinator (Mike Beauchene 860-424-4185).

In addition to the resources within the Bureau of Water Management, the DEP's Office of Communication and Environmental Education maintains an environmental monitoring training facility in Derby, CT (http://www.dep.state.ct.us/educ/bethany.htm). The facility is equipped with a modern chemistry laboratory, a life science classroom and a computer laboratory.

The Center for Environmental Research Education
(formerly Bethany Technical Training Center) provides resources and education programs for volunteer monitors to help in their task of obtaining technical scientific information. Programs include environmental habitat evaluation techniques, biological inventorying techniques, map reading, map making and surveying techniques, environmental chemistry monitoring and mathematical modeling.

Inquires regarding upcoming workshops can be made by calling the facilities manager, Alberto Mimo, at (203) 734-2513.

TIERED APPROACH TO VOLUNTEER MONITORING:

Meaningful volunteer data can be collected at several different technical levels of effort. It is critical that a start-up monitoring program does not take on more than it can handle. When determining what, where, and when to monitor, a volunteer group should evaluate funding required, resources available, effort required, and the number of dedicated volunteers. The DEP recommends a tiered approach, beginning with observational monitoring. As a group acquires resources, volunteers, and information, the monitoring activities generally become more complex and shift focus. Regardless of the specific monitoring activity or tier level, each group will contribute meaningful information to the DEP provided protocols are followed.

Tier 1: Observational Monitoring

A.) Periodic Visual Observation

Some of the most valuable monitoring data volunteers can submit involves periodic visual observation of stream and near stream conditions. Citizen monitors can readily observe and document stream condition at multiple locations during optimal time frames (for example during or following storm events). This type of information is extremely difficult for DEP to obtain on a statewide basis.

Detailed observational data can augment the DEP's periodic physical, chemical, and biological data by providing day to day or week to week stream conditions. Even more importantly, citizens can potentially expedite water quality improvement by immediately notifying local officials or appropriate DEP staff of abnormal conditions at pump stations, catch basins, or stormwater outfalls which can initiate timely follow-up inspection by regulatory personnel.

At this level of monitoring volunteers can select sites that are easily observed during normal day to day activities (for example, driving to work, fishing, or hiking). If an abnormal situation is observed, volunteers contact appropriate local or state officials. The most useful information will be detailed documentation of both normal and abnormal conditions.

DEP use of data:
*Initiate timely inspection by regulatory personnel.
*Identify potential water quality problems.
* Prioritize site selection for additional monitoring.
* General or more frequent information from waterbodies not routinely monitored or monitored infrequently.

Volunteer Resources: A single individual can collect this type of monitoring data with limited effort and time. Periodic visual observations require minimal training, equipment, and management, but strict adherence to detailed written documentation is necessary.

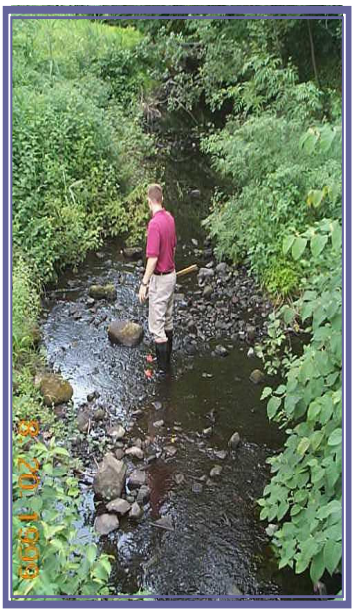
B.) Stream walks

A stream walk is a one-time comprehensive visual assessment of a continuous section of a stream or streams within a watershed. The goal is to provide information about the stream channel and surrounding land use. In addition, volunteers document "areas of concern", which may impair water quality or warrant further investigation. The major benefits of stream walks are the information from continuous sections of stream and the resource stewardship it fosters among participants. Stream walks may be structured to provide participants with opportunities to learn about the links between land use and stream water quality, the process of resource management, and encourage partnership with local planners and regulatory agencies.

DEP encourages groups interested in organizing a stream walk follow the protocols developed by the USDA Natural Resources Conservation Service. The materials for the stream walk have been standardized and can be found at: **http://www.ct.nrcs.usda.gov/ctthames/images/strmindx.htm**

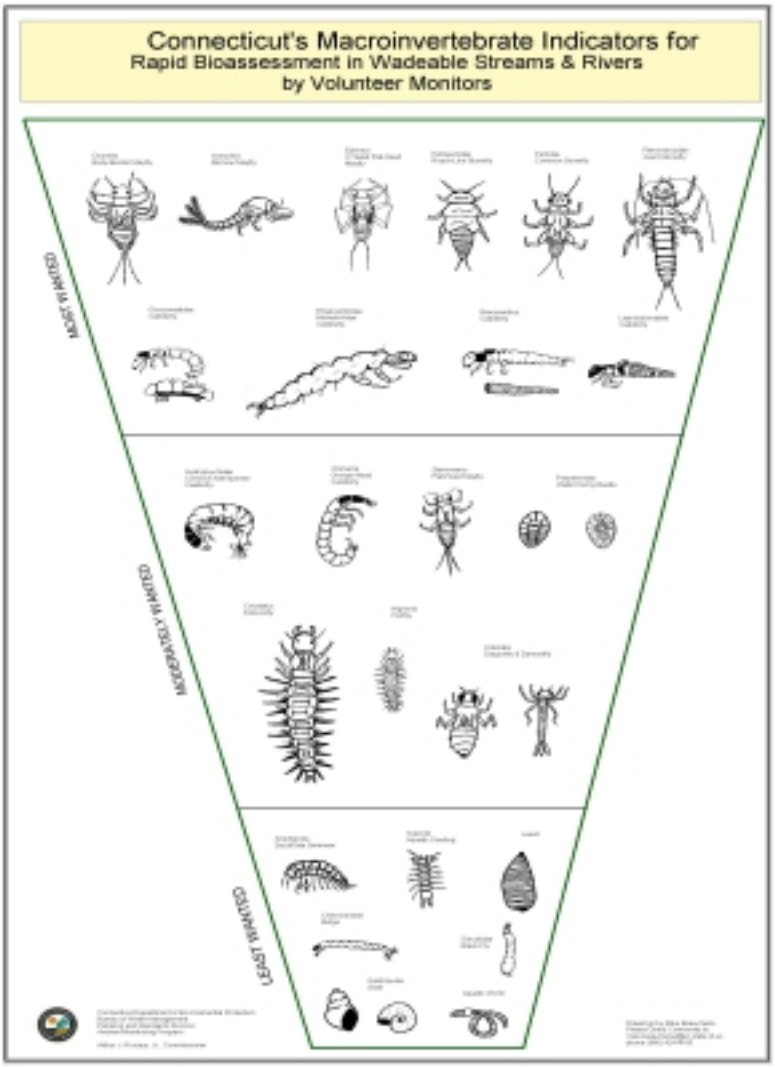
DEP use of data:
* Identify potential water quality problems.
* Prioritize site selection for additional monitoring or inspection.
* Develop an inventory of stream channel condition for continuous sections of a stream(s) from waterbodies not routinely monitored.

Volunteer Resources: This type of monitoring requires little commitment from the volunteers but substantial commitment to: organize the walk; training session; recruit participants; and, compiling a report of the results. For the volunteer, a single day of training as well as time to complete assigned section of stream corridor is required.



Tier 2: Rapid Bioassessment in Wadeable Streams and Rivers By Volunteer Monitors (RBV)

Due to the utility of macroinvertebrate data, many monitoring groups have implemented methods that model the RBP III used by the DEP. However, most monitors will agree that this process is anything but rapid. Even the most dedicated volunteers can struggle with the tedium of macroinvertebrate family level identifications. Rapid Bioassessment for Volunteers (RBV) capitalizes on the utility of macroinvertebrate data while keeping the methods and equipment straightforward, standardized, inexpensive, and most importantly "rapid".



Groups following the RBV protocol survey a stream site for a limited group of specified macroinvertebrates, each of which provide key ecological information about the stream environment (Figure 4). During the fall volunteers collect a sample of the benthic community and determine the relative abundance (none, few, some or many) of each macroinvertebrate on the provided list. A completed data sheet and voucher collection is submitted to the DEP. The entire RPV protocol is completed streamside by 2 to 3 monitors within 2 hours.

Figure 4 . Macroinvertebrates listed in the Rapid Bioassessment for Volunteers Protocol.

The most valuable information will come from groups who are able to complete the process accurately at multiple sites (**during a single day in the fall**) along a reach of river that is not routinely monitored by DEP. By evaluating the relative abundance of key organisms in the benthic community at each site and establishing baseline information, subtle changes can be detected. In some situations the current DEP monitoring protocol may be necessary to definitively assess water quality.

The DEP volunteer monitoring coordinator, currently Mike Beauchene (860 424-4185), maintains a database (Microsoft Access) linked to a geographic information system (Arcview). All voucher collections submitted to the DEP monitoring program are verified, cataloged, and stored at the DEP ambient monitoring laboratory.

DEP use of data:

* Identify potential water quality problems.
*The voucher collection will provide a record of the benthic community for the collection date and time.
* As a screening tool to identify stream sections with either very high or very low water quality.
* Provide information from streams not routinely monitored by the DEP.
* Prioritize site selection for additional monitoring.

Volunteer Resources: This type of monitoring requires moderate commitment from volunteers and is best accomplished by 2-3 people per site including at least 1 person who has experience with the protocol. Each team should commit 1 day for training and 2-4 hours to complete their collection. A program coordinator will need to make a moderate time commitment to (1) recruit participants, (2) provide training, (3) organize collection dates, and (4) submit the voucher collections and copies of the datasheets to the DEP. The volunteer organization will need to provide a number of low-cost items like boots or waders, topographic maps, ice cube trays, and isopropyl alcohol. Some equipment including the collection net is available for short-term loan from the DEP.

Tier 3: SPECIFIC MONITORING PLAN INCLUDING A DETAILED QUALITY ASSURANCE / QUALITY CONTROL (QA/QC) PLAN

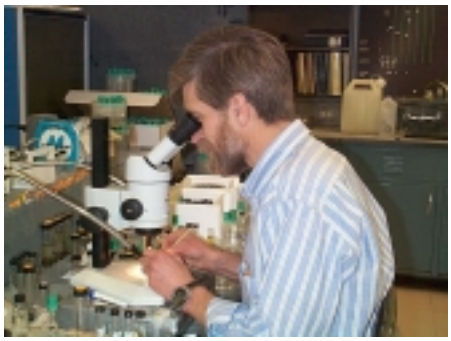
Traditional monitoring parameters (temperature, pH, dissolved oxygen, nutrients, indicator bacteria, and family level macroinvertebrate identification) can be used by DEP on an individualized basis. However, due to the limitations of grab sample chemistry, timing of sample collection, equipment required, and rigors of quality assurance and quality control, this type of monitoring is not initially recommended. Volunteer monitors and DEP staff must invest substantial time and effort to develop an appropriate monitoring plan for a group interested in pursuing this type of program.

Information from tier 3 will result from a detailed monitoring plan specifically designed to provide scientific information pertaining to a distinct water quality issue. To insure usable high quality data, each plan should be co-developed by the monitoring group and the DEP.

DEP use of data:

* To identify potential water quality problems.
* To provide scientific information regarding a specific monitoring question for selected parameters.
* To provide scientific data from established monitoring stations between scheduled DEP sampling.
* To prioritize site selection for additional monitoring.

Volunteer Resources: This type of monitoring requires an extensive commitment from the volunteers as well as the project manager, involving multiple training sessions, sampling events, lengthy laboratory analysis, and strong data management skills. Additionally, prior to commencing monitoring, a detailed QA/QC plan must be reviewed and approved by the DEP (and EPA if the project is funded through a section 319 NPS grant or other sources of EPA funds).



DEP MONITORING, TRAINING, AND WATERSHED COORDINATOR INFORMATION:

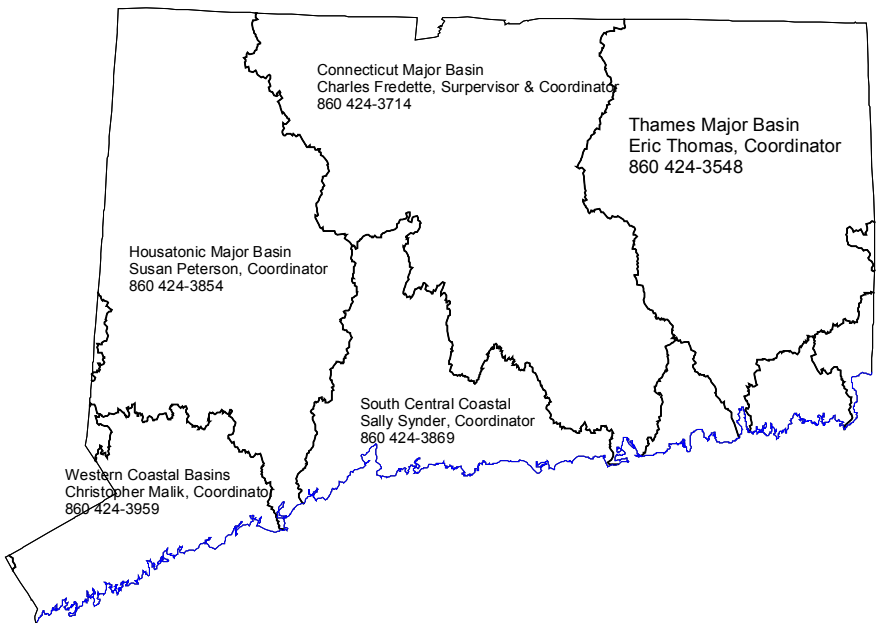
FOR INFORMATION REGARDING VOLUNTEER MONITORING, DEP MONITORING OR GENERAL WATERSHED INFORMATION PLEASE CONTACT:

Mike Beauchene
Volunteer Monitoring Coordinator
phone (860) 424-4185
E-mail Mike.Beauchene@po.state.ct.us.

FOR INFORMATION REGARDING WORKSHOPS AND VOLUNTEER MONITORING TRAINING PLEASE CONTACT:

Alberto Mimo
Director
Center for Environmental Research Education
(formerly Bethany Technical Training Center)
http://www.dep.state.ct.us/educ/bethany.htm
PO Box 435
500 Hawthorne Avenue
Derby, CT 06418
(203) 734-2513

FOR SPECIFIC QUESTIONS REGARDING WATER QUALITY MANAGEMENT ISSUES WITHIN A MAJOR WATERSHED, PLEASE CONTACT THE APPROPRIATE COORDINATOR LISTED BELOW:



ADDITIONAL RESOURCES FOR VOLUNTEER MONITORS:

The resources listed below provide excellent information about volunteer monitoring however, not all may be useful for contributing data to DEP.

http://www.epa.gov/owow/monitoring/vol.html

This site provides electronic versions of many of EPA's volunteer methods manuals and brochures, as well as The Volunteer Monitor Newsletter, the national newsletter of the volunteer monitoring community.

http://water.nr.state.ky.us/ww/vm.htm

Are volunteer monitoring groups on line? Do they need to be? The answer is yes to both questions. Electronic mail and the World Wide Web are proving to be popular tools for a number of groups. If an organization has a question about water quality, a recent query of the term "Water Quality" on an on-line search service yielded more than 30,000 web pages that dealt with the topic. For Volunteer Monitoring in particular there were more than 2000 pages listed. A search of EPA's site alone yielded 340 documents that referenced "Volunteer Monitoring".

So you don't have the time to sort through all those pages for something useful? We have done that for you. The list below is an *incomplete* summary of high-quality web sites that deal directly with the field of volunteer monitoring. If your site isn't on here, let us know, we will add it!

http://www.iwla.org/siteindx.htm

This is the website for one of the oldest and largest volunteer monitoring programs in the country. Variants of the Save Our Streams methods are in use in many states.

http://www.riverwatch.org

We offer workshops, organizational and technical support and consultation, publications, and other tools that help groups and individuals monitor and protect rivers.
So rather than send do-it-yourself kits with instructions for water sampling, we guide people through an 11-step process developed during the course of our work with thousands of volunteers since 1987. We teach scientifically credible methods for collecting and analyzing water samples and documenting findings. Then we recommend actions for river protection and improvement, and develop plans for making sure that those recommendations are acted on by regulatory agencies and government authorities.

http://www.ag.ohio-state.edu/~waternet

This site provides information about how to get involved in volunteer monitoring, not only in Ohio but through other Cooperative Extension programs.

http://www.edc.uri.edu/rreapage/h2owatch

The University of Rhode Island Watershed Watch Program (URIWW) is a statewide

volunteer monitoring program. It focuses on providing current information on the water quality of surface water resources throughout Rhode Island, including lakes, ponds, reservoirs, rivers, streams and the marine environment.

The heart of the program consists of weekly measurements taken by numerous trained volunteer monitors. The program emphasizes watershed scale monitoring because the water quality of a given body of water is a reflection of the activities in the lands and waters that surround it and lie upstream.

The program is intended to encourage communities and shoreline residents to understand the need to cooperatively manage and improve the water quality of all the water bodies within a watershed. In this way we can ensure that Rhode Island's bays, estuaries, and freshwater resources remain one of the state's great assets.

http://www.epa.gov/surf/

Surf Your Watershed is a service to help you locate, use, and share environmental information on your watershed or community. A driving force behind Surf Your Watershed is to get environmental information into the hands of active citizens and groups and to help those people connect and share information, ideas, and assistance. EPA supports the public's right-to-know and hopes that Surf Your Watershed will contribute to the public's understanding of environmental issues.

http://www.epa.gov/OWOW/monitoring/

This homepage contains a wide variety of resources for anyone interested in learning more about water quality monitoring, automated data management, and geographic information systems. We have provided many actual USEPA guidance documents, fact sheets, and final reports, and will be adding new documents as they become available. You may order many of these articles by visiting the Information Resources and Services homepage under the Office of Wetlands, Oceans, and Watersheds.

http://www.epa.gov/owow/monitoring/volunteer/stream/

The purpose of this manual is not to mandate new methods or override methods currently being used by volunteer monitoring groups. Instead, it is intended to serve as a tool for program managers who want to launch a new stream monitoring program or enhance an existing program. *Volunteer Stream Monitoring* presents methods that have been adapted from those used successfully by existing volunteer programs.

Further, it would be impossible to provide monitoring methods that are uniformly applicable to all stream watersheds or all volunteer programs throughout the Nation. Factors such as geographic region, program goals and objectives, and program resources will all influence the specific methods used by each group. This manual therefore urges volunteer program coordinators to work hand-in-hand with state and local water quality professionals or other potential data users in developing and implementing a volunteer

monitoring program. Through this partnership, volunteer programs gain improved credibility and access to professional expertise and data; agencies gain credible data that can be used in water quality planning. Bridges between citizens and water resource managers are also the foundation for an active, educated, articulate, and effective constituency of environmental stewards. This foundation is an essential component in the management and preservation of our water resources.

http://www.epa.gov/OWOW/monitoring/volunteer/qappcovr.htm
The quality assurance project plan, or QAPP, is a document that outlines the procedures that those who conduct a monitoring project will take to ensure that the data they collect and analyze meets project requirements. It is an invaluable planning and operating tool that outlines the project's methods of data collection, storage and analysis. It serves not only to convince skeptical data users about the quality of the project's findings, but also to record methods, goals and project implementation steps *for current and future volunteers* and for those who may wish to use the project's da ta over time.

Developing a QAPP is a dynamic, interactive process that should ideally involve quality assurance experts, potential data users, and members of the volunteer monitoring project team. It is not an easy process. This document is designed to encourage and facilitate the development of volunteer QAPPs by clearly presenting explanations and examples. Readers are urged to consult, as well, the additional resources listed in the appendices to this document, and to contact their state or U.S. Environmental Protection Agency (EPA) Regional quality assurance staff for specific information or guidance on their projects.

http://www.epa.gov/OWOW/monitoring/volunteer/vm_index.html
The Volunteer Monitor newsletter facilitates the exchange of ideas, monitoring methods, and practical advice among volunteer environmental monitoring groups across the nation.

Correspondence

Address all correspondence regarding the newsletter to:

Eleanor Ely, Editor
The Volunteer Monitor
1318 Masonic Avenue
San Francisco, CA 94117
telephone (415) 255-8049

http://www.epa.gov/owow/monitoring/rbp/ As the technical guidance for biocriteria has been developed by EPA, states have found these protocols useful as a framework for their monitoring programs. This document was meant to have a self-corrective process as the science advances; the implementation by state water resource agencies has contributed to refinement of the original RBPs for regional specificity. This revision reflects the advancement in bioassessment methods since 1989 and provides an updated compilation of the most cost-effective and scientifically valid approaches.